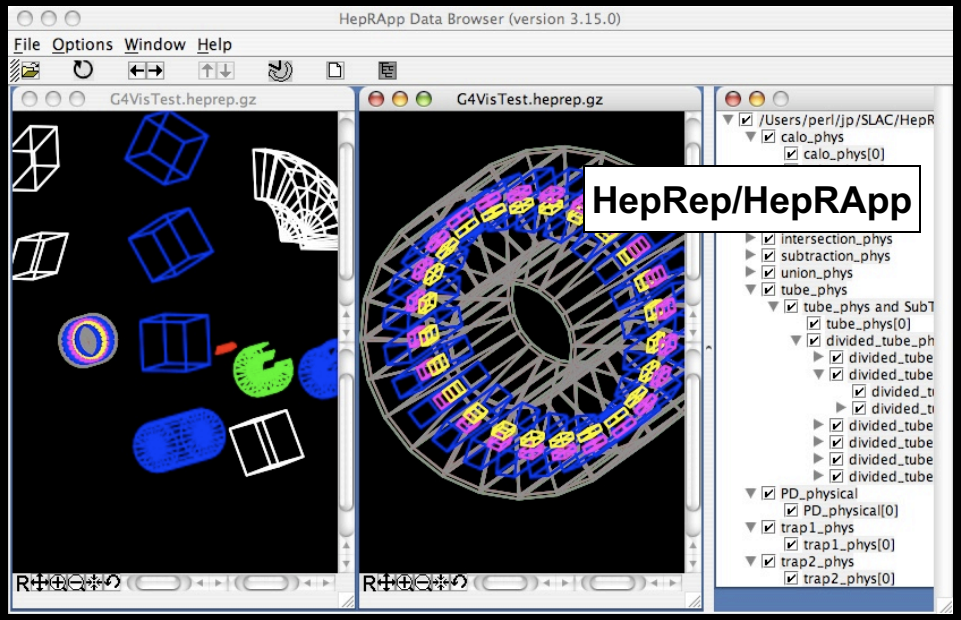
Geant4 Visualization

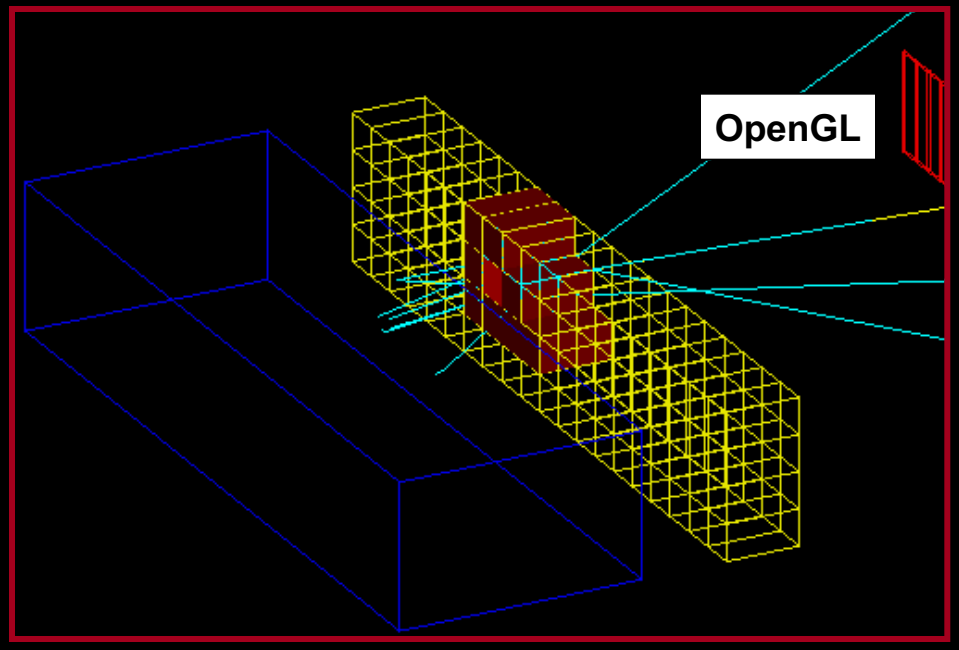
Slide created by Andrea Dotti and Joseph Perl

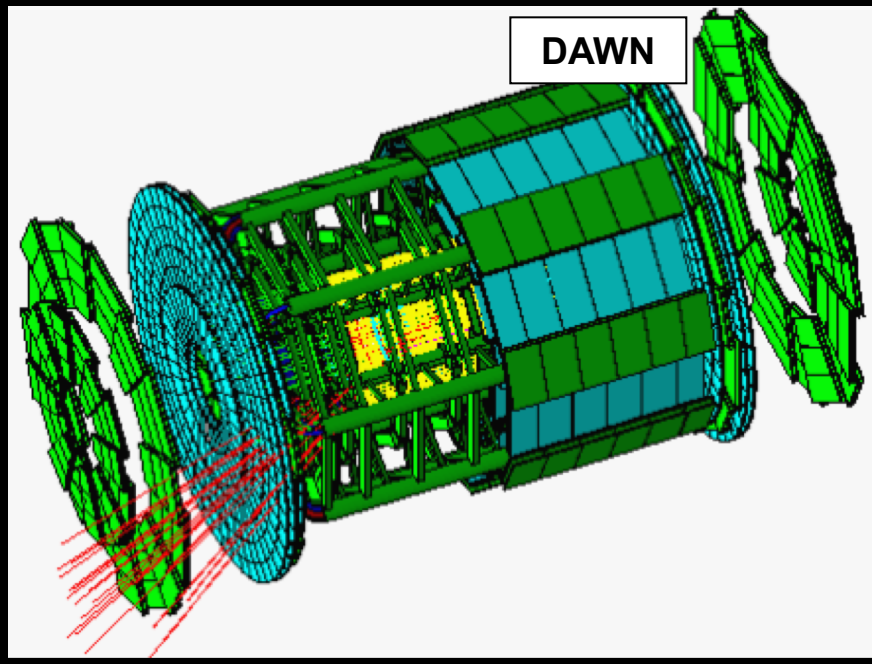
U.S. DEPARTMENT OF ENERGY
Office of Science

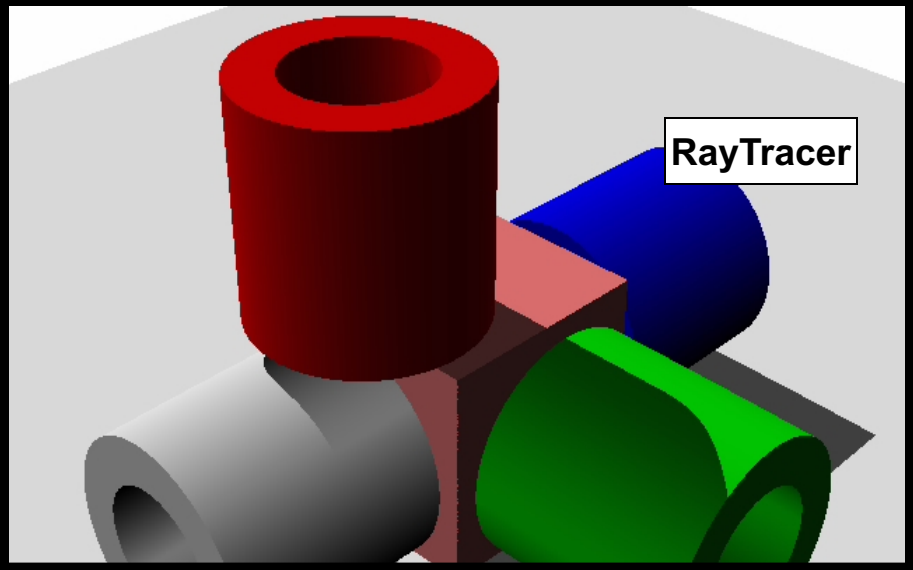
SLAC NATIONAL ACCELERATOR LABORATORY

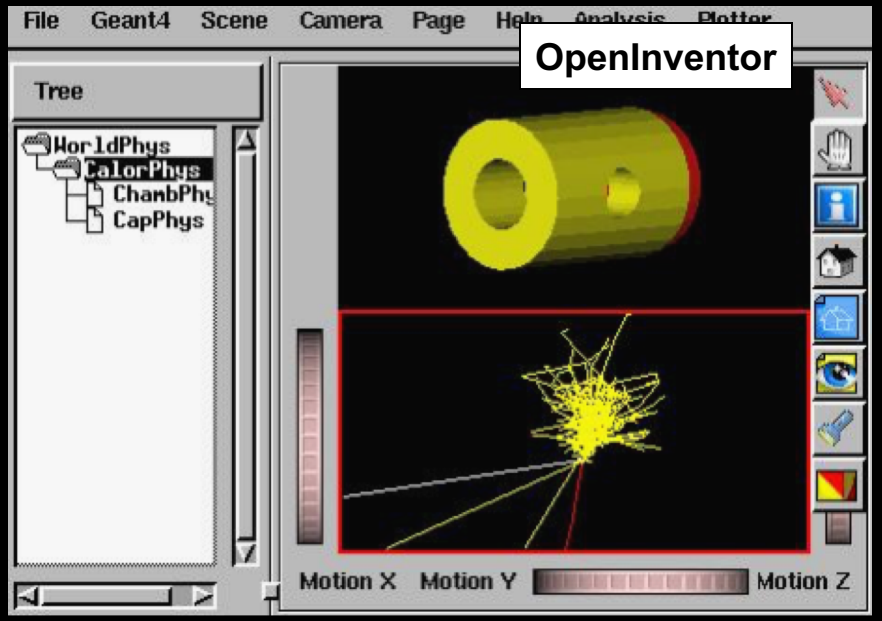


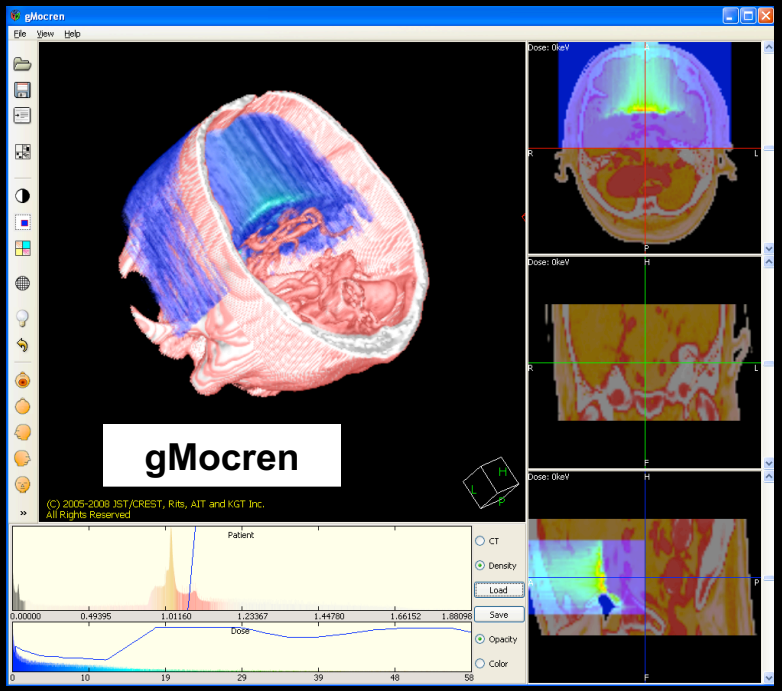
Slides from Joseph Perl (SLAC) and Laurent Garnier (LAL/IN2P3)

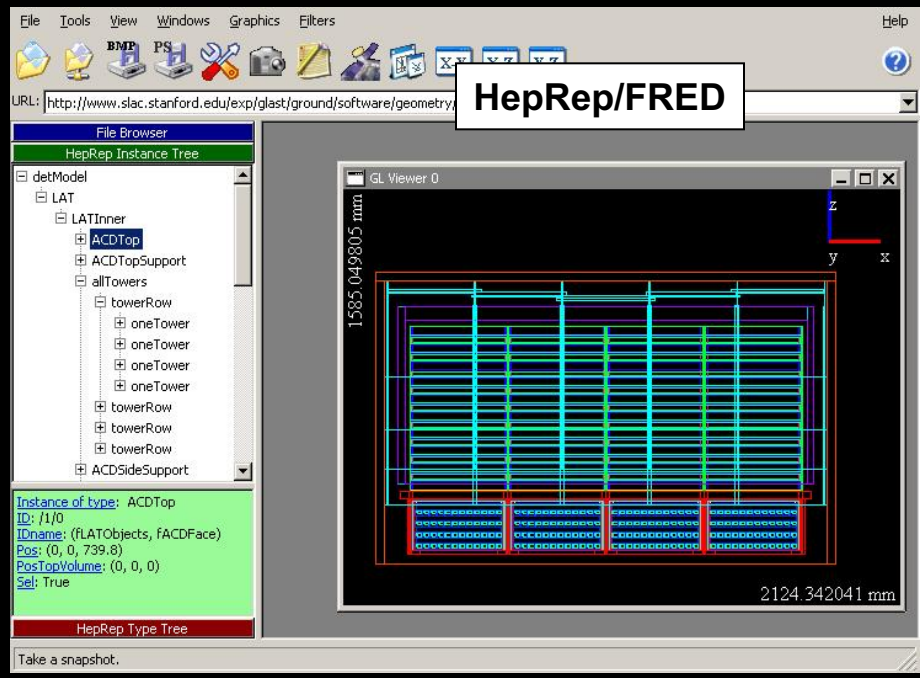





RayTracer


File
Geant4
Scene
Camera
Page
Help
Analysis
Plotter
OpenInventor
Tree
WorldPhys
CalorPhys
ChambPhy
CapPhys
Motion X
Motion Y
Motion Z


gMocren
File
View
Help
(C) 2005-2008 JST/CREST, Rits, AIT and KGT Inc.
All Rights Reserved
Patient
Dose
CT
Density
Load
Save
Opacity
Color


File
Tools
View
Windows
Graphics
Filters
Help
URL: http://www.slac.stanford.edu/exp/glast/ground/software/geometry/
HepRep/FRED
File Browser
HepRep Instance Tree
detModel
LAT
LATInner
ACDTop
ACDTopSupport
allTowers
towerRow
oneTower
oneTower
oneTower
oneTower
towerRow
towerRow
towerRow
ACDSideSupport
Instance of type: ACDTop
ID: /1/0
IDname: (fLATObjects, fACDFace)
Pos: (0, 0, 739.8)
PosTopVolume: (0, 0, 0)
Sel: True
HepRep Type Tree
GL Viewer 0
1585.049805 mm
2124.342041 mm
Take a snapshot.

G4UI Session

Vis parameters

Viewer components

Help

Search :

Command
- /vis/filtering/
- /vis/geometry/
- /vis/scene/
- /vis/sceneHandler/
- /vis/viewer/
  - /vis/viewer/set/
    - /vis/viewer/set/all
    - /vis/viewer/set/autoRefresh
    - /vis/viewer/set/auxiliaryEd...
    - /vis/viewer/set/background
    - /vis/viewer/set/culling
    - /vis/viewer/set/cutawayMo...
    - /vis/viewer/set/edge
    - /vis/viewer/set/explodeFac...
    - /vis/viewer/set/globalLine...
    - /vis/viewer/set/globalMark...
    - /vis/viewer/set/hiddenEdge
    - /vis/viewer/set/hiddenMar...
    - /vis/viewer/set/lightsMove
    - /vis/viewer/set/lightsTheta...
    - /vis/viewer/set/lightsVector
    - /vis/viewer/set/lineSegme...
    - /vis/viewer/set/picking
    - /vis/viewer/set/projection
    - /vis/viewer/set/sectionPlane
    - /vis/viewer/set/style
    - /vis/viewer/set/targetPoint
    - /vis/viewer/set/upThetaPhi

Command /vis/viewer/set/hiddenMarker
Guidance :
If true, closer objects hide markers.
Otherwise, markers always show.

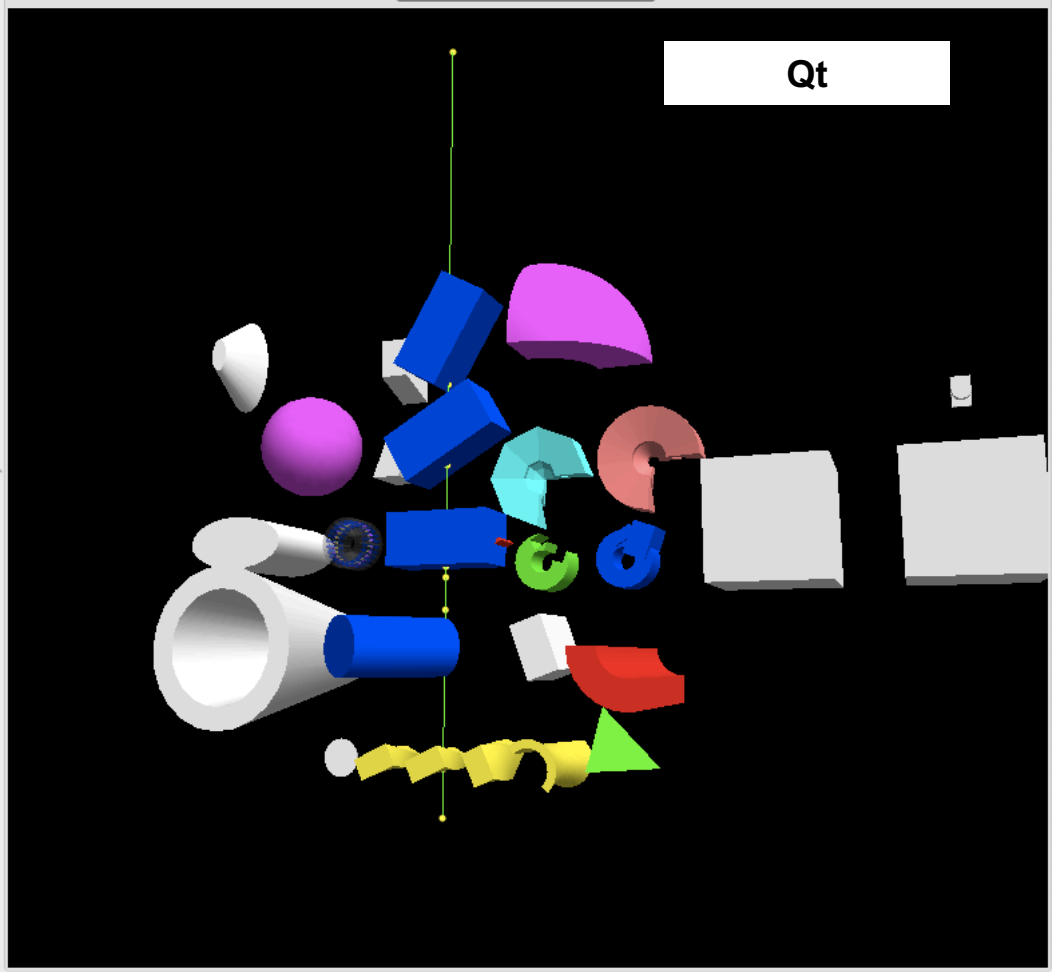
Parameter : hidden-marker
Parameter type : b
Omittable : True
Default value : 1

Cout

History

Session :

viewer-1 (OpenGLStoredQt)



Tutorials

http://goo.gl/8jYGek

What Can be Visualized

SLAC

Simulation data can be visualized:

- Geometrical components
- Particle trajectories and tracking steps
- Hits of particles in the geometry
- Scored energy, dose, etc.

Other user defined objects can be visualized:

- Polylines
  - such as coordinate axes
- 3D Markers
  - such as eye guides
- Text
  - descriptive character strings
  - comments or titles

Choices

SLAC

Driver	Variant	Hight quality print	Interactive	browse geometry hierarchies	Direct access to G4 kernel	Make movies	Web
OpenGL	X						
	Xm						
	Qt						
	Win32						
OpenInventor	Xt						
	Win32						
DAWN							
VRML							
HepRep							
gMocren							
RayTracer							
ASCII Fille							

- You may ask why Geant4 has so many different visualization systems.
- This is a natural result of Geant4 being a toolkit and not a single application.

- To support user communities who incorporate Geant4 into their own pre-existing software frameworks, Geant4 visualization is built around a set of well defined interfaces.
  - These interfaces make it straightforward to connect Geant4's core visualization tools to any visualization system
    - able to drive advanced systems that can natively display complex solids such as Geant4's cut cylinders
    - able to drive more basic systems that do not understand such solids (system can ask Geant4 visualization to deconstruct complex solids into simpler polygons)
  - For those users who want a ready-made visualization solution from Geant4, these same interfaces have made it straightforward for us to provide a variety of solutions, each with particular areas of strength.

- Interfaces discussed in detail in: The Geant4 Visualisation System
  J Allison, M Asai, G Barrand, M Donszelmann, K Minamimoto, J Perl, S Tanaka, E Tcherniaev, J Tinslay, Computer Physics Communications, Volume 178, Issue 5, 331-365, 1 March 2008

Controlling Visualization

SLAC

Your Geant4 code stays basically the same no matter which driver you use

Visualization is performed either with commands or from C++ code

- For the present tutorial, we confine ourselves to command-driven visualization.

Some visualization drivers work directly from Geant4

- OpenGL
- OpenInventor
- RayTracer
- ASCIITree

For other visualization drivers, you first have Geant4 produce a file,
and then you have that file rendered by another application (which may have GUI control)

- HepRepFile
- DAWNFILE
- VRML2FILE
- gMocrenFile

You can open more than one driver at a time.

- For example, do a quick check in OpenGL,
  then save the same event for a beautiful DAWN plot

Controlling Which Drivers are Available

SLAC

Six of the visualization drivers are always included by default
(since they require no external libraries):

- HepRepFile
- DAWNFILE
- VRMLFILE
- RayTracer
- gMocrenFile
- ASCIITree

Other visualization drivers are included only if you request them in your cmake options.

You can also add your own visualization driver.

- Geant4's visualization system is modular. By creating just three new classes, you can direct Geant4 information to your own visualization system.

Simplest command example

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- Visualize your geometry in OpenGL
  - `/vis/open OGL`
  - `/vis/drawVolume`
- Most examples come with a visualization macro more complete: good starting point

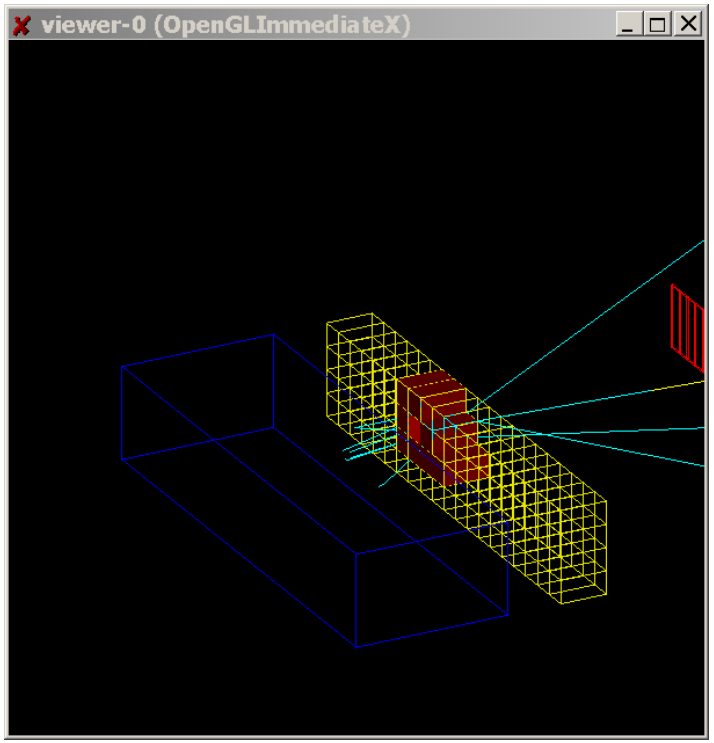
Screenshots on the Visualization drivers

- OpenGL
- OpenInventor
- HepRep
- DAWN
- VRML
- RayTracer
- gMocren

OpenGL

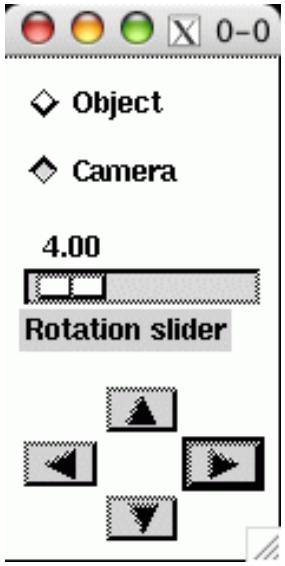
- /vis/open OGL

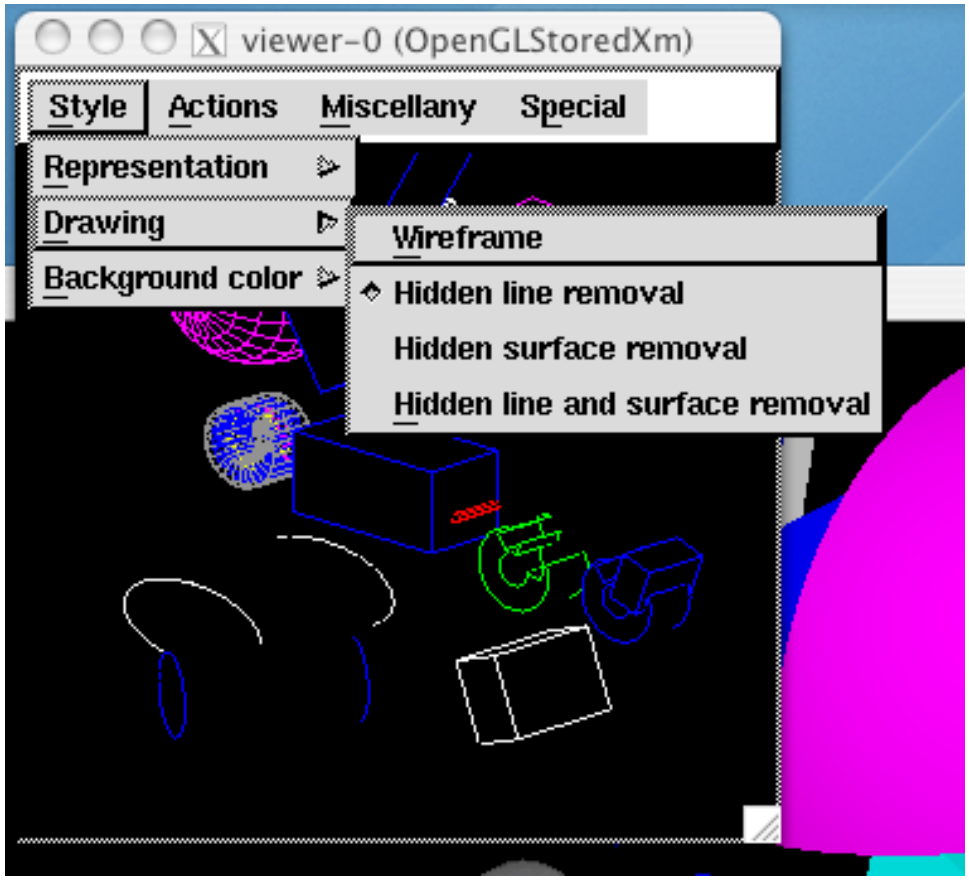
- Features
  - Control directly from Geant4
  - Uses GL libraries that are already included on most Linux and Windows systems
  - Rendered, photorealistic image with some interactive features
    - zoom, rotate, translate
  - Fast response (can usually exploit full potential of graphics hardware)
  - Save as pixel graphics or vector EPS
  - Live movies



OpenGL with Motif Control

- Somewhat obsolete now that Qt can take over this functionality
  - but still supported
  - requires that you have Motif and link against this in your Geant4





DAWN

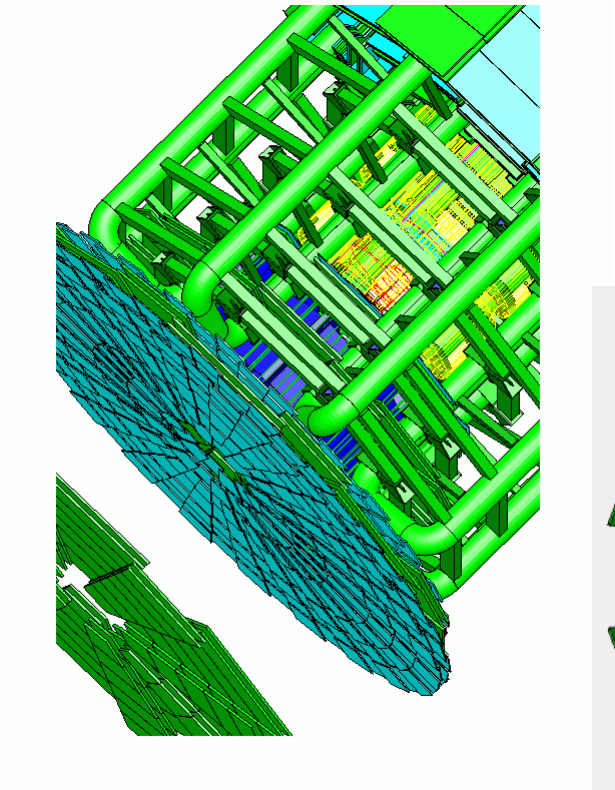
- /vis/open DAWNFILE

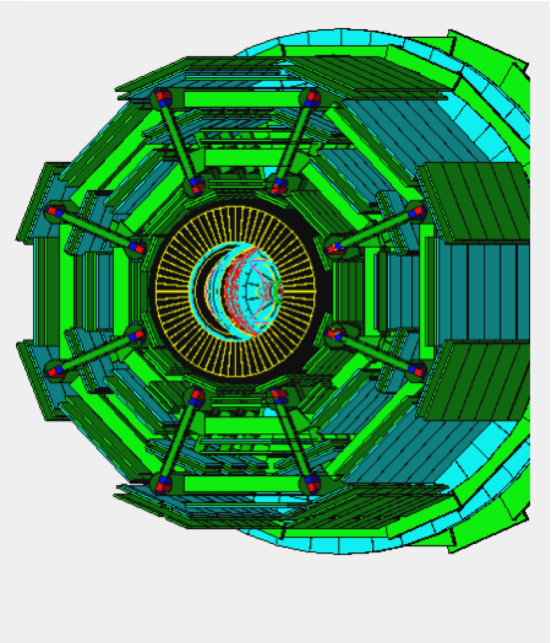
- Features
  - Create a .prim file
  - Requires DAWN, available for all Linux and Windows systems
  - DAWN creates a rendered, photorealistic PostScript image
  - No interactive features once at PostScript stage
  - Highest quality technical rendering - vector PostScript
  - View or print from your favorite PostScript application

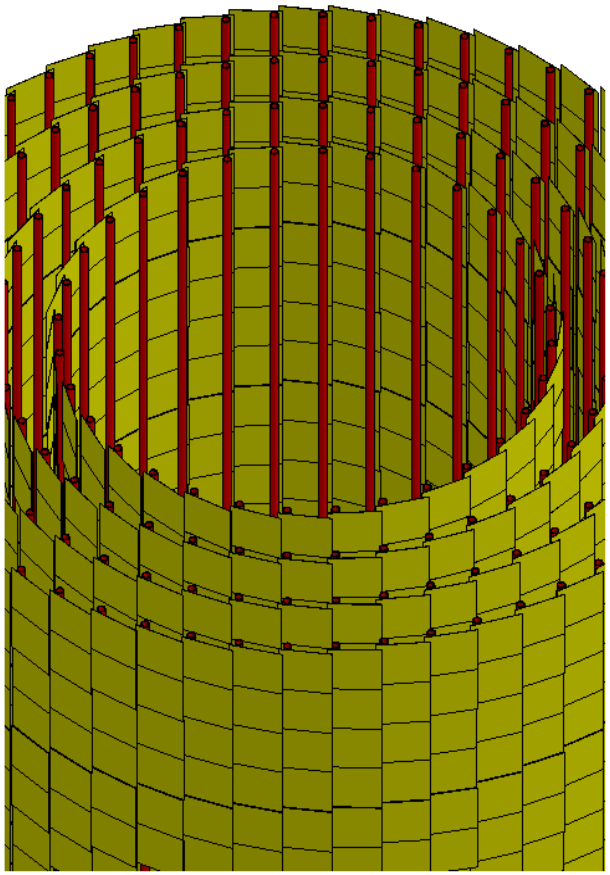
DAWN Examples

From a repository of images at

- http://geant4.kek.jp/~tanaka/GEANT4/ATLAS_G4_GIFFIG/







DAWNCUT and DAVID

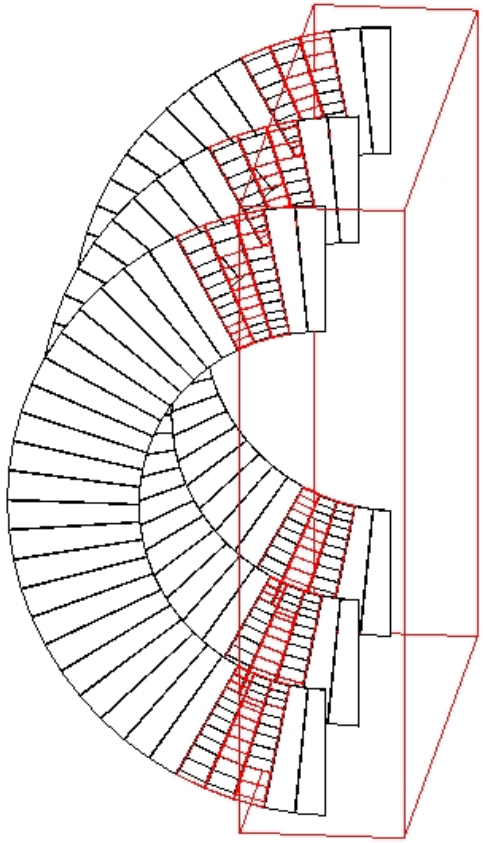
A standalone program, DAWNCUT, can perform a planar cut on a DAWN image.

- DAWNCUT takes as input a .prim file and some cut parameters. Its output is a new .prim file to which the cut has been applied.

Another standalone program, DAVID, can show you any volume overlap errors in your geometry.

- DAVID takes as input a .prim file and outputs a new .prim file in which overlapping volumes have been highlighted.

Details at http://geant4.kek.jp/~tanaka/



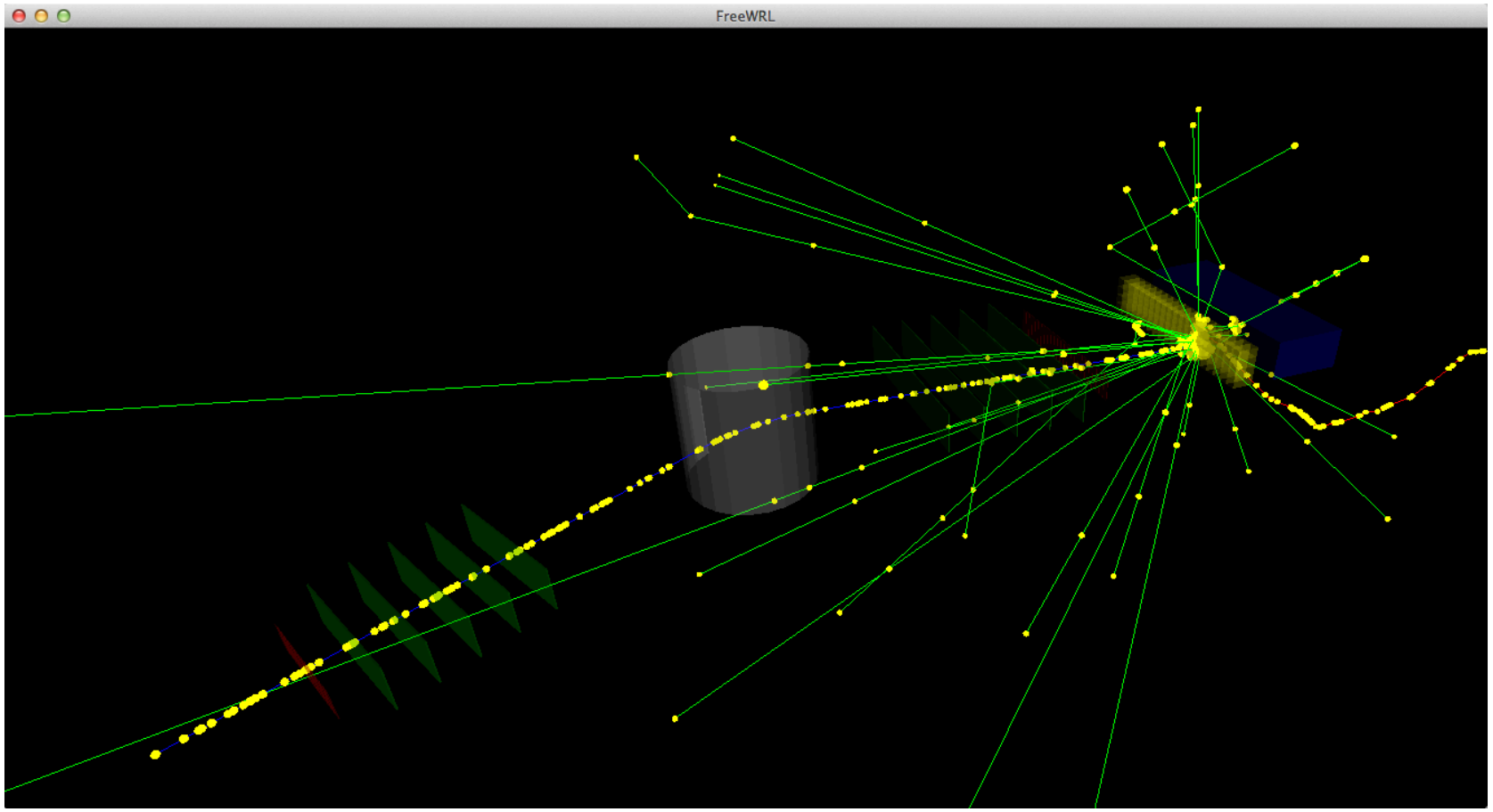
VRML

- /vis/open VRML1FILE or /vis/open VRML2FILE

- Features
  - Create a file to view in any VRML browser (some as web browser plug-ins).
  - Requires VRML browser (many different choices for different operating systems).
  - Rendered, photorealistic image with some interactive features
    - zoom, rotate, translate
  - Limited printing ability (pixel graphics, not vector graphics)

VRML

- Geant4 creates VRML File
  - /vis/open VRML1FILE or /vis/open VRML2FILE
- View file in a VRML Browser
  - Many free options, for example, here is one from freeWRL



RayTracer

- /vis/open RayTracer

- Features
  - Create a jpeg file
    (and with RayTracerX option, also draws to x window)
  - Forms image by using Geant4's own tracking to follow photons through the detector
  - Can show geometry but not trajectories
  - Can render any geometry that Geant4 can handle (such as Boolean solids) - no other Vis driver can handle every case
  - Supports shadows, transparency and mirrored surfaces

RayTracer

RayTracer works by using Geant4's own tracking to shoot photons through the detector onto a sensitive plane. The resulting image is presented as a jpeg file.

- /vis/open RayTracer

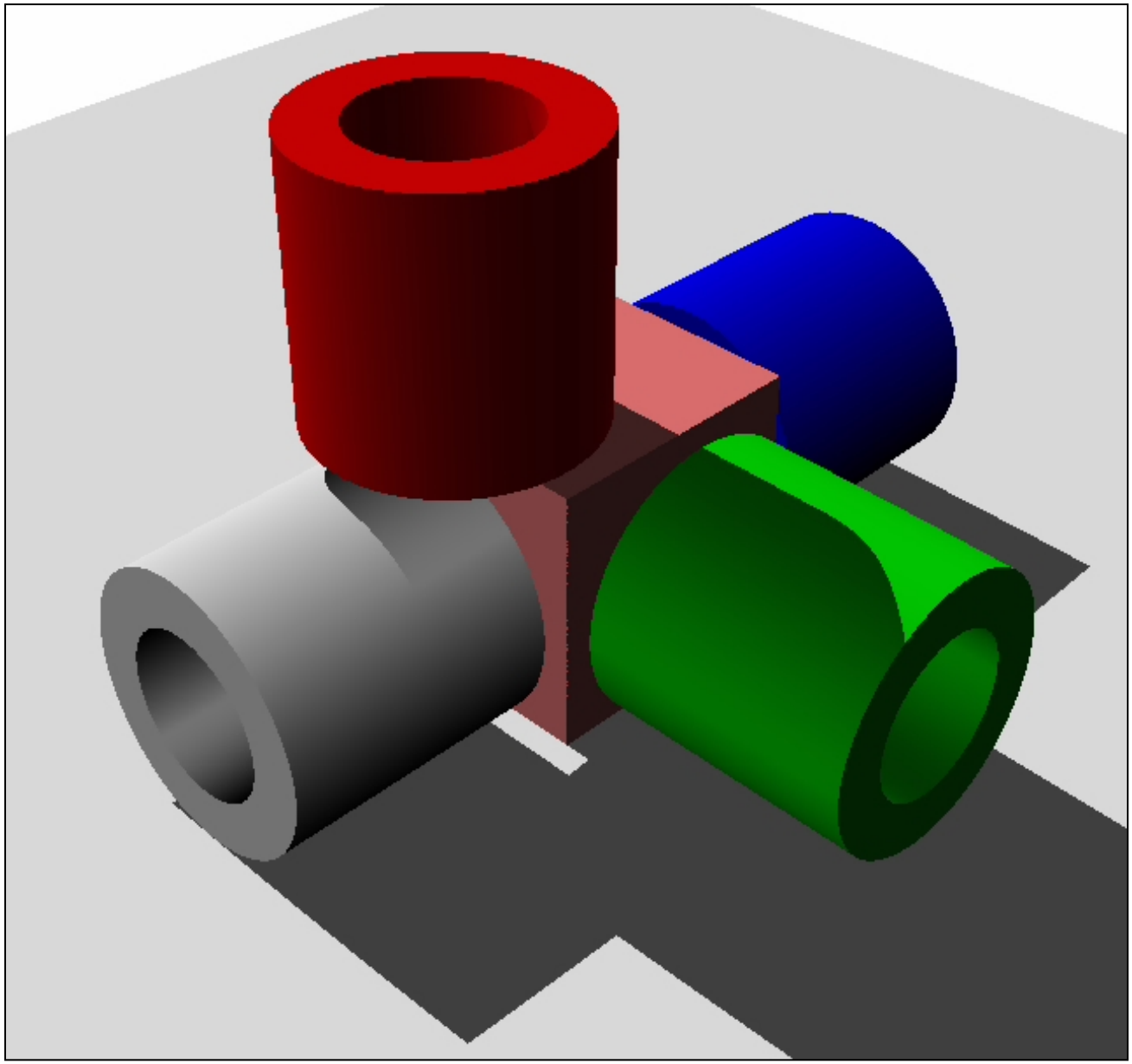
Some pieces of geometries may fail to show up in other visualization drivers (due to algorithms those drivers use to compute visualizable shapes and polygons), but RayTracer can handle any geometry that the Geant4 navigator can handle.

RayTracer can not be used to visualize Trajectories.

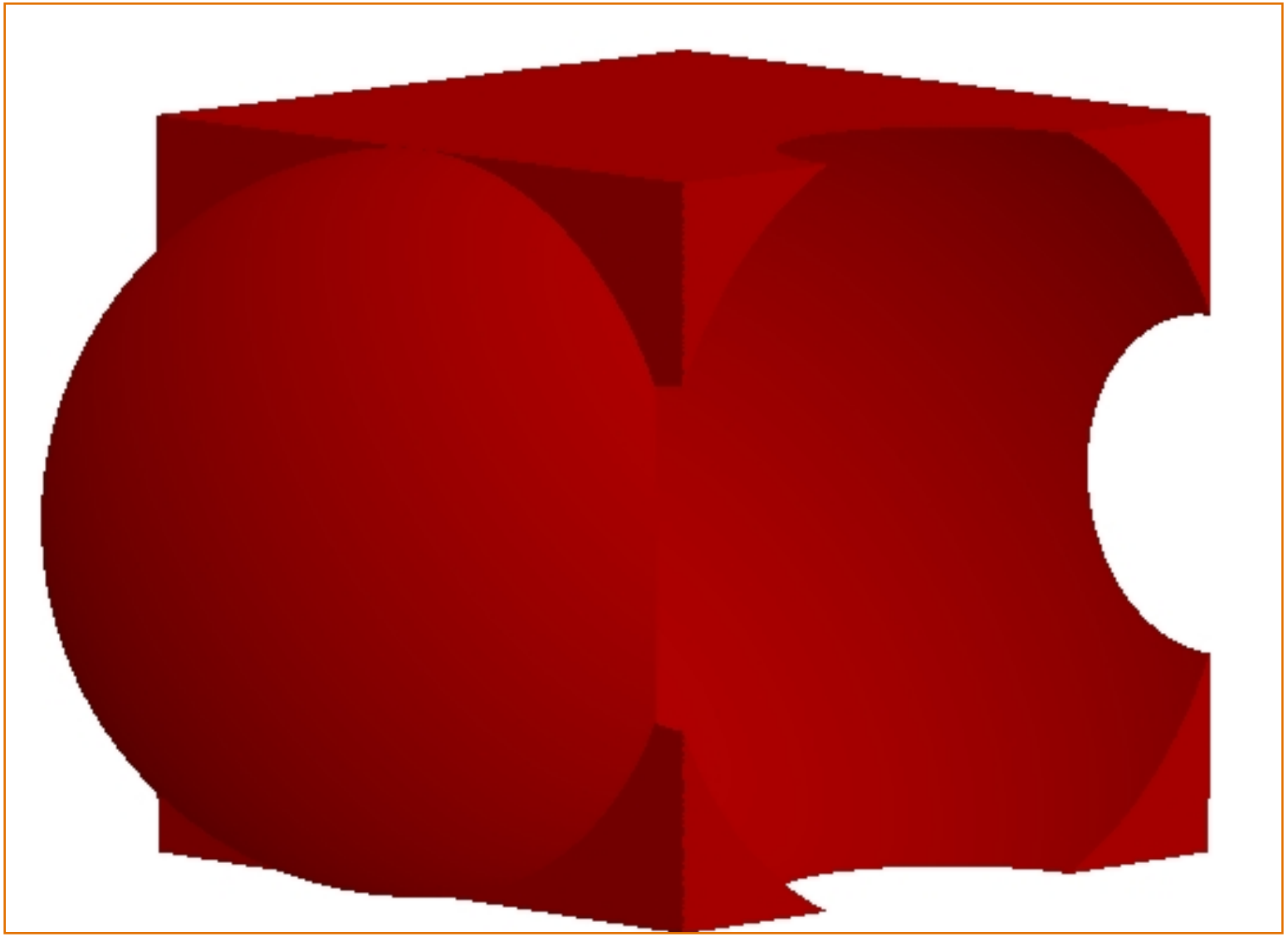
Commands:

- 1) trace * Start the ray tracing.
- 2) column * Define the number of horizontal pixels.
- 3) row * Define the number of vertical pixels.
- 4) target * Define the center position of the target.
- 5) eyePosition * Define the eye position.
- 6) lightDirection * Define the direction of illumination light.
- 7) span * Define the angle per 100 pixels.
- 8) headAngle * Define the head direction.
- 9) attenuation * Define the attenuation length for transparent material.
- 10) distortion * Distortion effect of the fish eye lens.
- 11) ignoreTransparency * Ignore transparency even if the alpha of G4Colour < 1
- 12) backgroundColour * Set background colour: red green blue: range 0.->1.

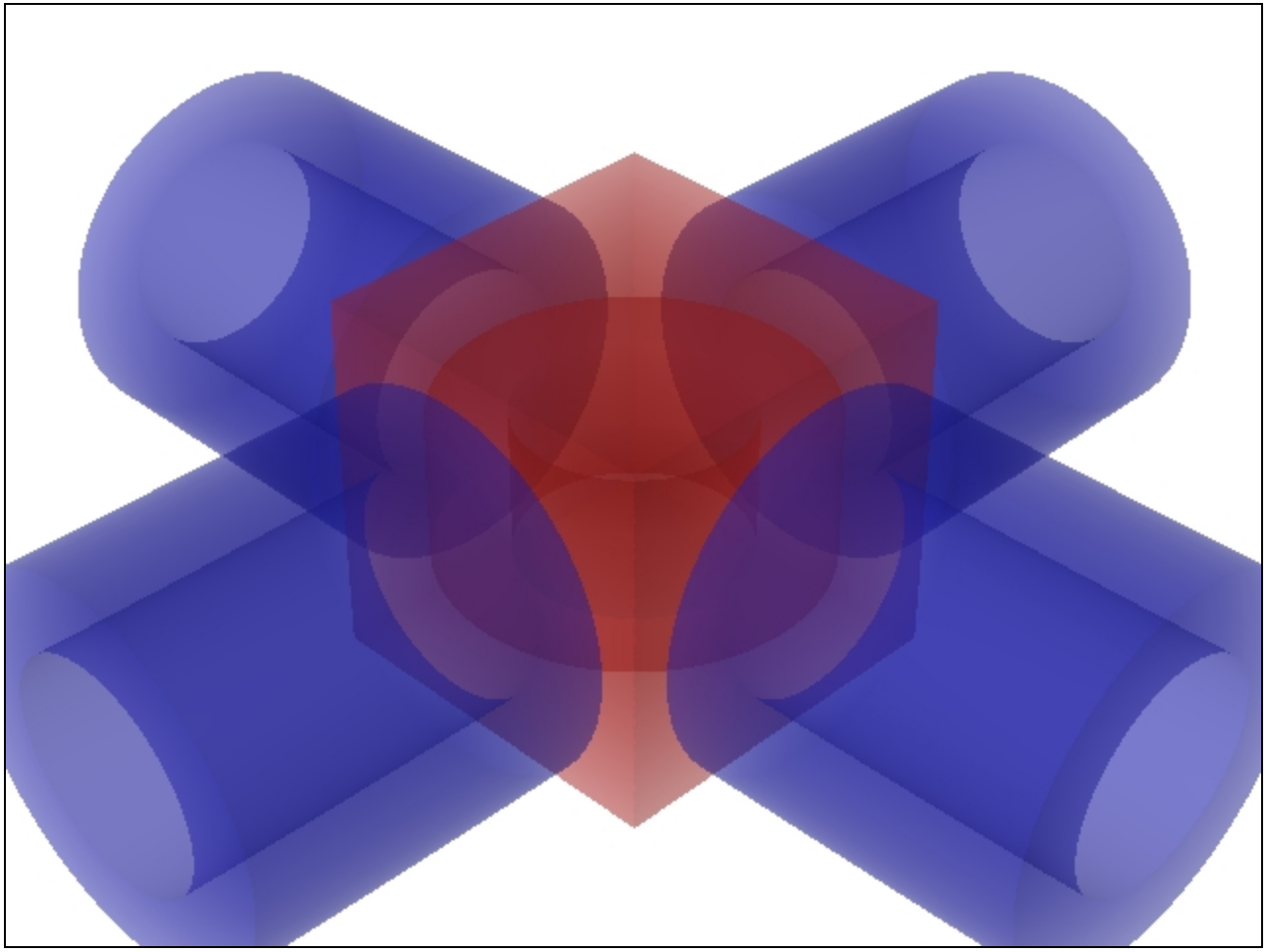
RayTracer Shows Shadows



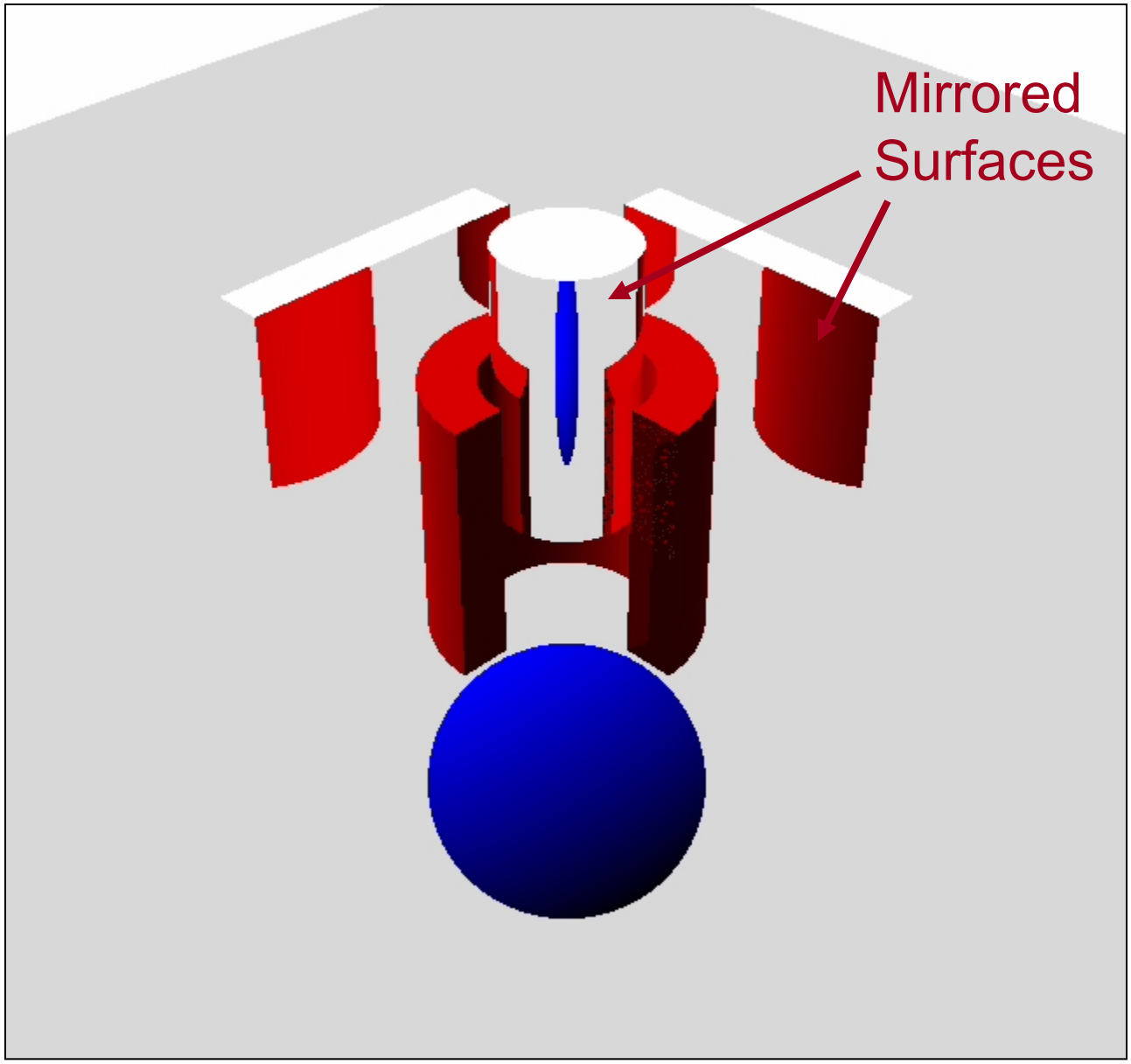
RayTracer Handles Boolean Solids



RayTracer Supports Transparency



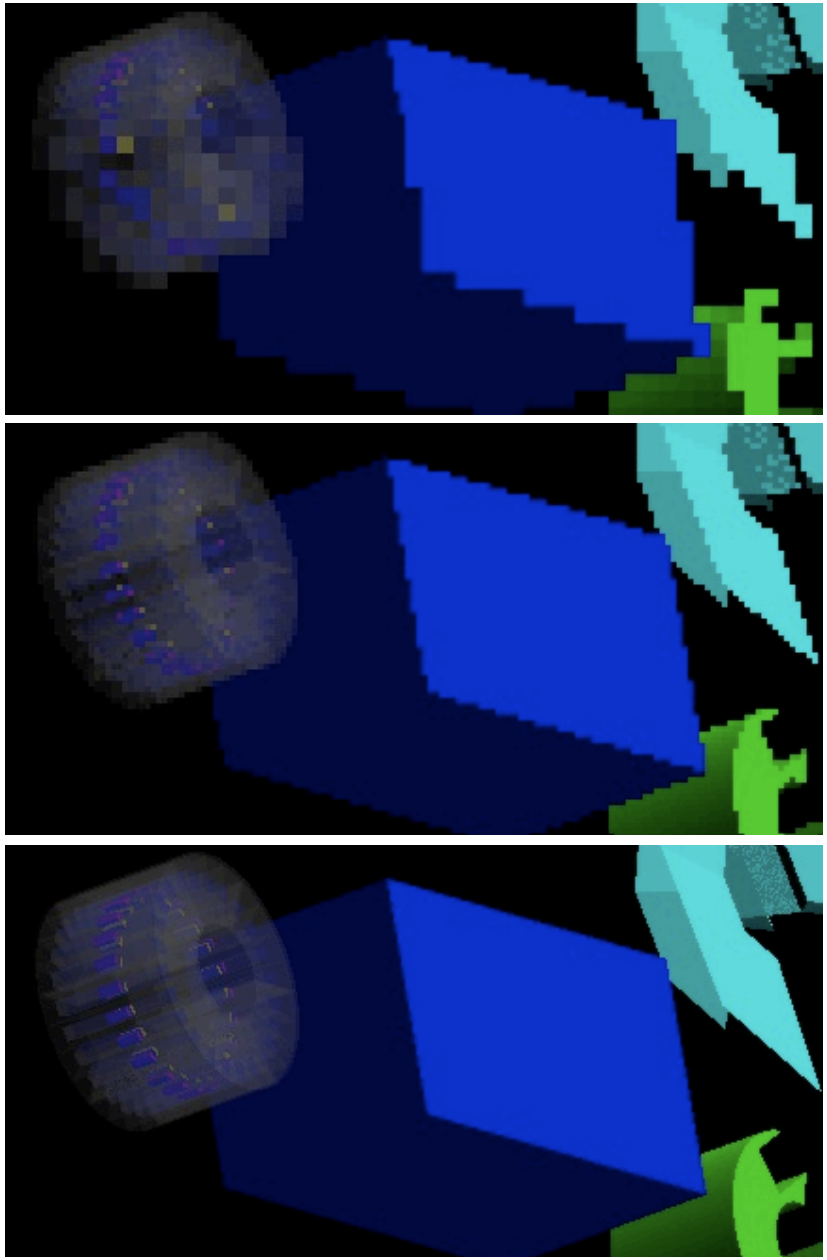
RayTracer Handles Mirrored Surfaces



RayTracerX

- New since Geant4.8.0
- In addition to
  - /vis/open RayTracer
- You have the option of
  - /vis/open RayTracerX

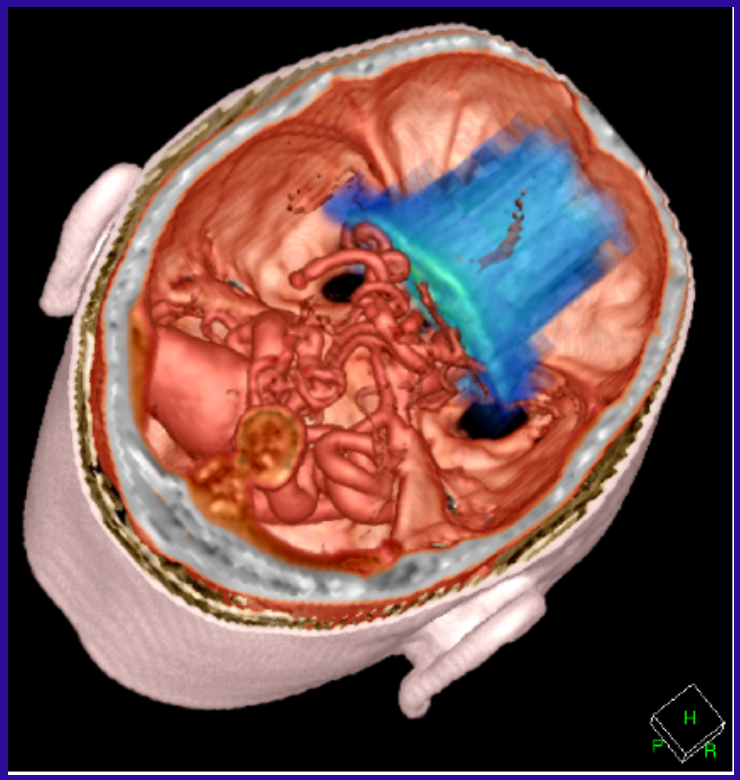
- Builds same jpeg file as RayTracer, but simultaneously renders to screen so you can watch as rendering grows progressively smoother.
- Means you can abort and retry the rendering with different view parameters without having to wait for the complete refinement of the image.



gMocren

Great tool available for volume visualization

- From JST/CREST project (Japan) to improve Geant4 for medical physics
- Able to visualize:
  - Volume data
    (including overlay of more than one set)
  - Trajectories
  - Geometry
- Runs on:
  - Windows and Linux
  - Mac will likely happen soon
  - Based on a commercial package but offered freely to all Geant4 users
  - http://geant4.kek.jp/gMocren
  - Installation is straightforward, follow the Download link on the above page
    - First run gMocren's one-click installer
    - Then, inside <gMocren-dir>/gtk, you will find the one-click installer for gtk



ASCIITree

- /vis/open ATree
- Features
  - Text dump of the geometry hierarchy
  - Not graphical
  - Control over level of detail to be dumped
  - Can calculate mass and volume of any hierarchy of volumes

ASCIITree

- ASCIITREE is a visualization driver that is not actually graphical, but that dumps the hierarchy as a simple text tree.
  - /vis/open ATree

- /vis/viewer/flush
  - "worldPhysical":0
  - "magneticPhysical":0
  - "firstArmPhysical":0
  - "hodoscope1Physical":0
  - "hodoscope1Physical":1 (repeated placement)
  - "hodoscope1Physical":2 (repeated placement)
  - "hodoscope1Physical":3 (repeated placement)
  - "hodoscope1Physical":4 (repeated placement)

- Can be set to various levels of detail
  - /vis/ASCIITree/verbose <verbosity>
  - 0: prints physical volume name.
  - 1: prints logical volume name.
  - 2: prints solid name and type.
  - 3: prints volume and density of solid.
  - 4: calculates and prints mass(es) of volume(s) in scene.
  - By default, shows only daughters of first placement and not repeat replicas.
  - Add 10 to the above to also show repeated placements and replicas.

ASCIITree: Calculate Volume and Mass

- At verbosity level 4, ASCIITree calculates the mass of the complete geometry tree taking into account daughters up to the depth specified for each physical volume.
- The calculation involves subtracting the mass of that part of the mother that is occupied by each daughter and then adding the mass of the daughter, and so on down the hierarchy.
- /vis/ASCIITree/Verbose 4
- /vis/viewer/flush
- "HadCalorimeterPhysical":0 / "HadCalorimeterLogical" / "HadCalorimeterBox"(G4Box), 1.8 m3 , 11.35 g/cm3
  - "HadCalColumnPhysical":-1 (10 replicas) / "HadCalColumnLogical" / "HadCalColumnBox"(G4Box), 180000 cm3, 11.35 g/cm3
    - "HadCalCellPhysical":-1 (2 replicas) / "HadCalCellLogical" / "HadCalCellBox"(G4Box), 90000 cm3, 11.35 g/cm3
      - "HadCalLayerPhysical":-1 (20 replicas) / "HadCalLayerLogical" / "HadCalLayerBox"(G4Box), 4500 cm3, 11.35 g/cm3
        - » "HadCalScintiPhysical":0 / "HadCalScintiLogical" / "HadCalScintiBox"(G4Box), 900 cm3, 1.032 g/cm3
- Calculating mass(es)...
  - Overall volume of "worldPhysical":0, is 2400 m3
  - Mass of tree to unlimited depth is 22260.5 kg

Qt Driver (with OpenGL visualization)

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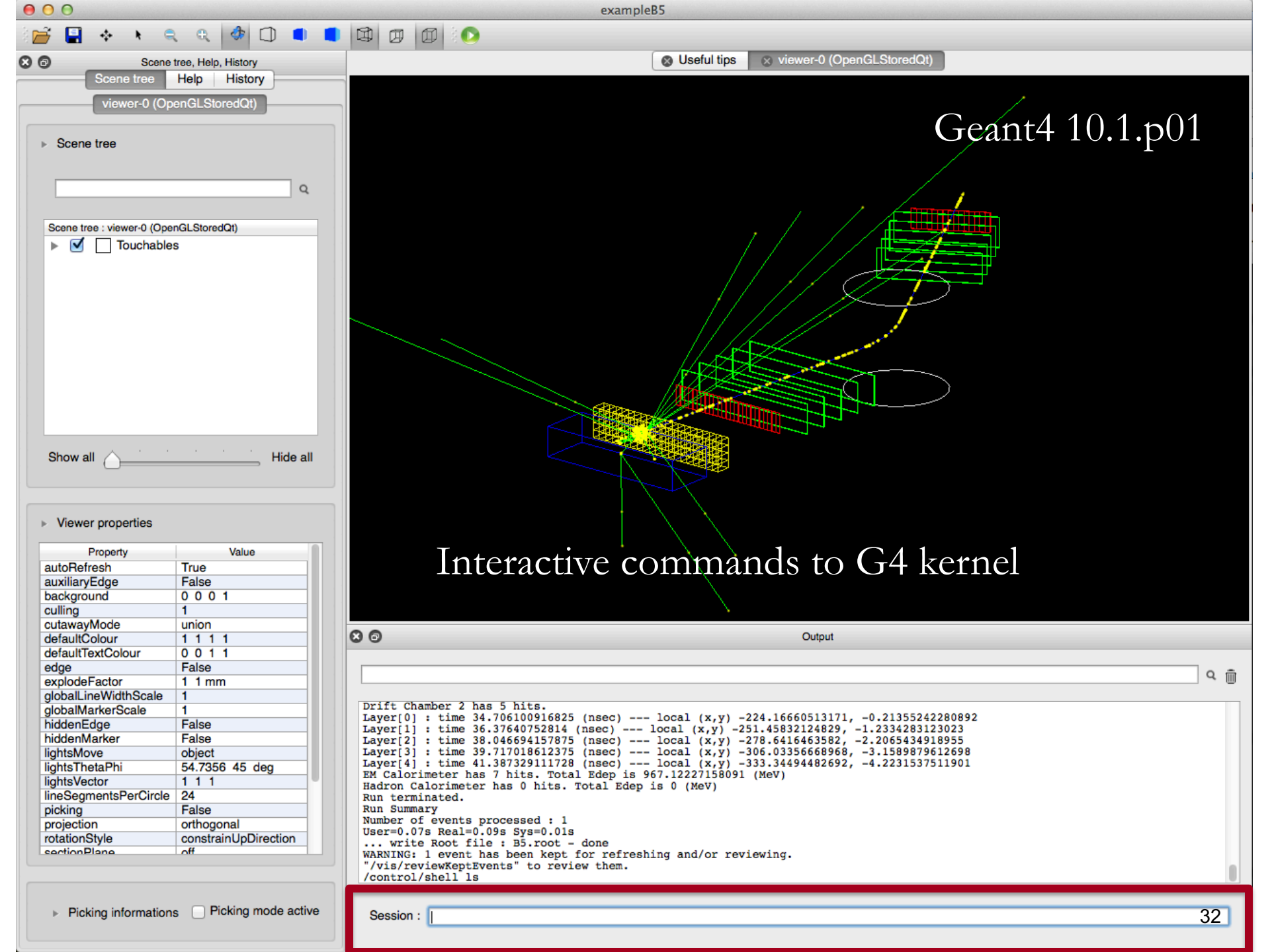
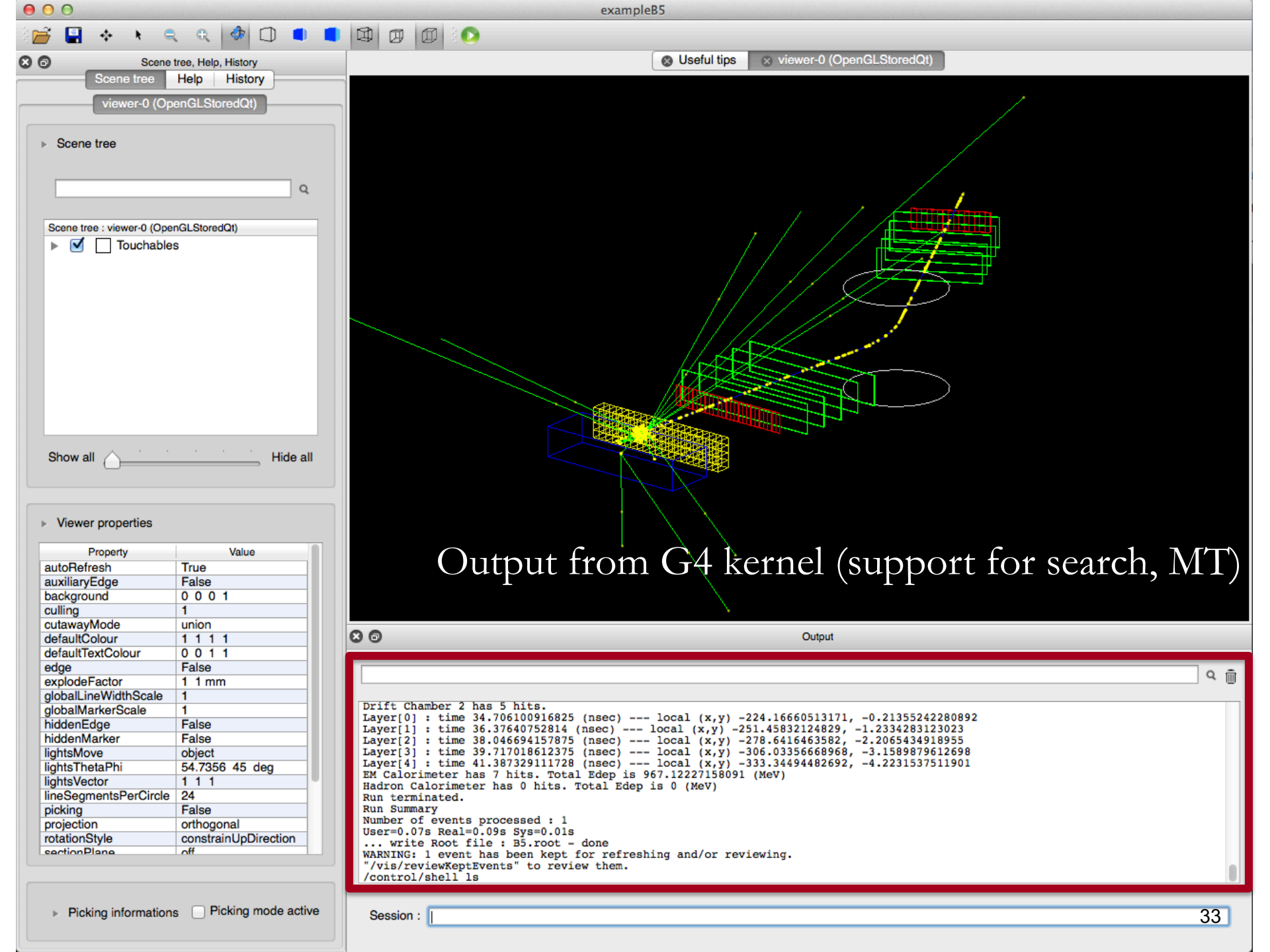
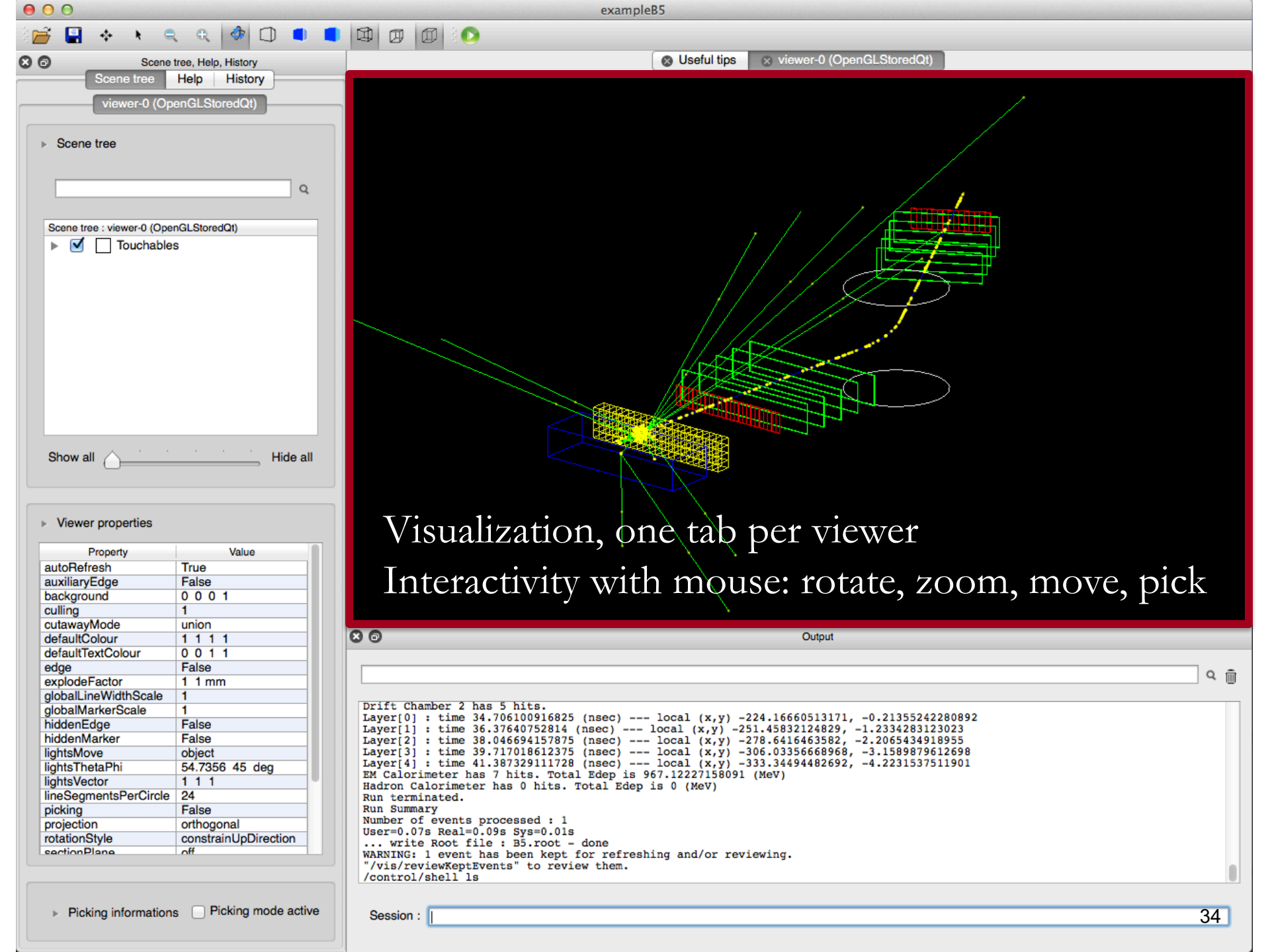
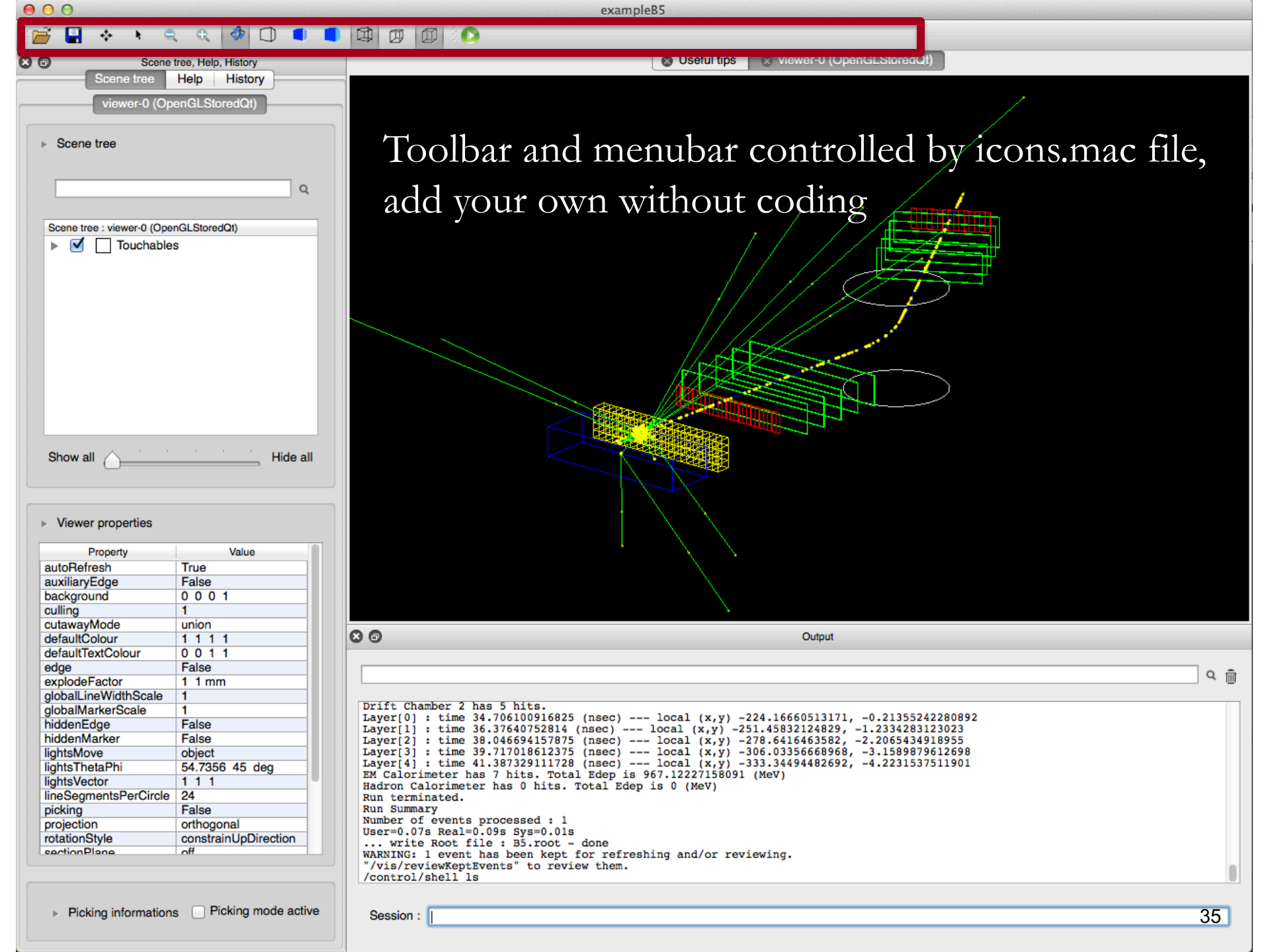
- Recent developments focused on Qt User Interface and Visualization

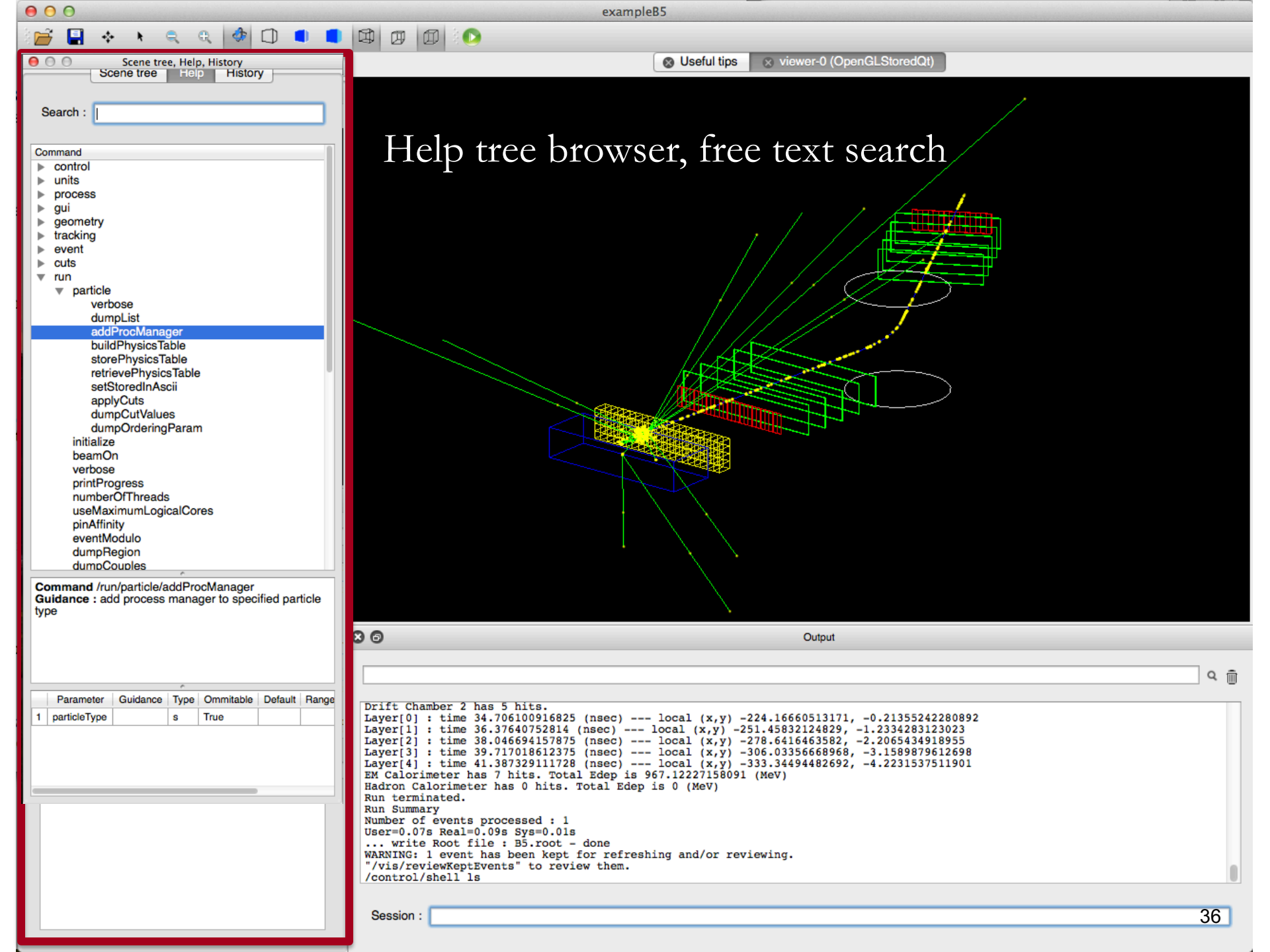
- Demo…

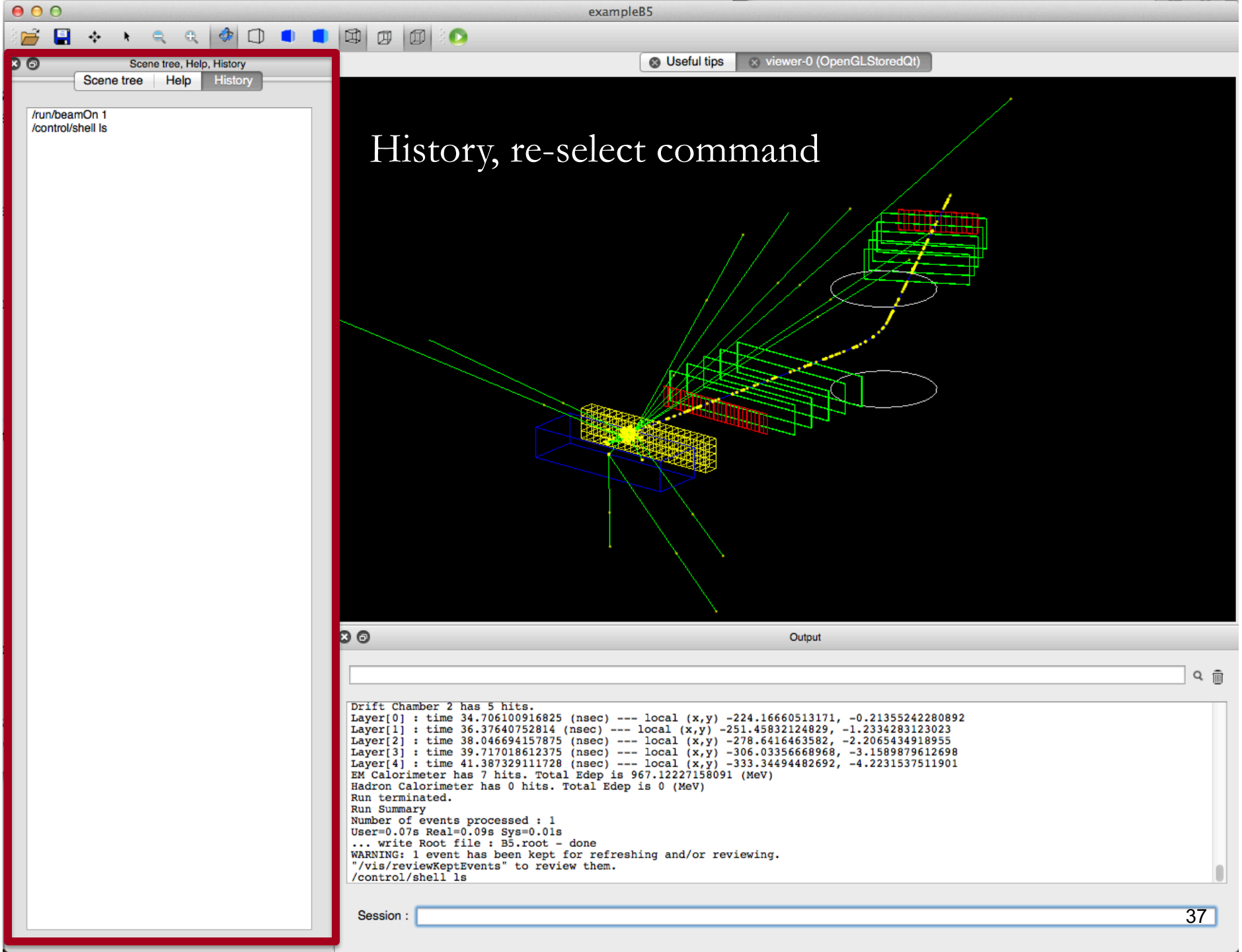

exampleB5
Scene tree, Help, History
Scene tree
Help
History
viewer-0 (OpenGLStoredQt)
Scene tree
Scene tree : viewer-0 (OpenGLStoredQt)
Touchables
Show all
Hide all
Viewer properties
Property
Value
autoRefresh
True
auxiliaryEdge
False
background
0 0 0 1
culling
1
cutawayMode
union
defaultColour
1 1 1 1
defaultTextColour
0 0 1 1
edge
False
explodeFactor
1 1 mm
globalLineWidthScale
1
globalMarkerScale
1
hiddenEdge
False
hiddenMarker
False
lightsMove
object
lightsThetaPhi
54.7356 45 deg
lightsVector
1 1 1
lineSegmentsPerCircle
24
picking
False
projection
orthogonal
rotationStyle
constrainUpDirection
Picking informations
Picking mode active
Useful tips
viewer-0 (OpenGLStoredQt)
Geant4 10.1.p01
Interactive commands to G4 kernel
Output
Drift Chamber 2 has 5 hits.
Layer[0] : time 34.706100916825 (nsec) --- local (x,y) -224.16660513171, -0.21355242280892
Layer[1] : time 36.37640752814 (nsec) --- local (x,y) -251.45832124829, -1.2334283123023
Layer[2] : time 38.046694157875 (nsec) --- local (x,y) -278.6416463582, -2.2065434918955
Layer[3] : time 39.717018612375 (nsec) --- local (x,y) -306.03356668968, -3.1589879612698
Layer[4] : time 41.387329111728 (nsec) --- local (x,y) -333.34494482692, -4.2231537511901
EM Calorimeter has 7 hits. Total Edep is 967.12227158091 (MeV)
Hadron Calorimeter has 0 hits. Total Edep is 0 (MeV)
Run terminated.
Run Summary
Number of events processed : 1
User=0.07s Real=0.09s Sys=0.01s
... write Root file : B5.root - done
WARNING: 1 event has been kept for refreshing and/or reviewing.
"/vis/reviewKeptEvents" to review them.
/control/shell ls
Session :
32

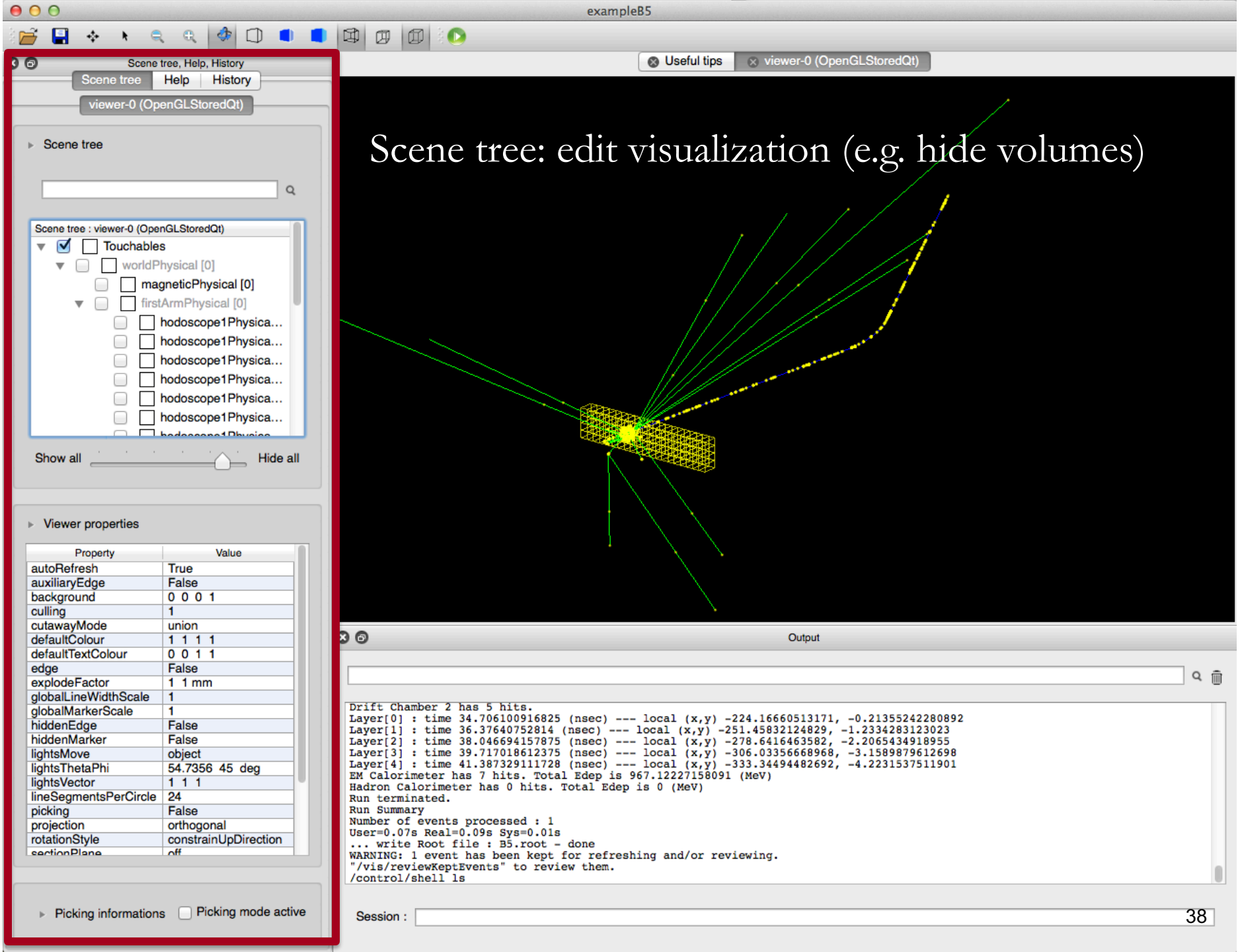

exampleB5
Scene tree, Help, History
Scene tree
Help
History
viewer-0 (OpenGLStoredQt)
Scene tree
Scene tree : viewer-0 (OpenGLStoredQt)
Touchables
Show all
Hide all
Viewer properties
Property
Value
autoRefresh
True
auxiliaryEdge
False
background
0 0 0 1
culling
1
cutawayMode
union
defaultColour
1 1 1 1
defaultTextColour
0 0 1 1
edge
False
explodeFactor
1 1 mm
globalLineWidthScale
1
globalMarkerScale
1
hiddenEdge
False
hiddenMarker
False
lightsMove
object
lightsThetaPhi
54.7356 45 deg
lightsVector
1 1 1
lineSegmentsPerCircle
24
picking
False
projection
orthogonal
rotationStyle
constrainUpDirection
Picking informations
Picking mode active
Useful tips
viewer-0 (OpenGLStoredQt)
Output from G4 kernel (support for search, MT)
Output
Drift Chamber 2 has 5 hits.
Layer[0] : time 34.706100916825 (nsec) --- local (x,y) -224.16660513171, -0.21355242280892
Layer[1] : time 36.37640752814 (nsec) --- local (x,y) -251.45832124829, -1.2334283123023
Layer[2] : time 38.046694157875 (nsec) --- local (x,y) -278.6416463582, -2.2065434918955
Layer[3] : time 39.717018612375 (nsec) --- local (x,y) -306.03356668968, -3.1589879612698
Layer[4] : time 41.387329111728 (nsec) --- local (x,y) -333.34494482692, -4.2231537511901
EM Calorimeter has 7 hits. Total Edep is 967.12227158091 (MeV)
Hadron Calorimeter has 0 hits. Total Edep is 0 (MeV)
Run terminated.
Run Summary
Number of events processed : 1
User=0.07s Real=0.09s Sys=0.01s
... write Root file : B5.root - done
WARNING: 1 event has been kept for refreshing and/or reviewing.
"/vis/reviewKeptEvents" to review them.
/control/shell ls
Session :
33


exampleB5
Scene tree, Help, History
Scene tree
Help
History
viewer-0 (OpenGLStoredQt)
Scene tree
Scene tree : viewer-0 (OpenGLStoredQt)
Touchables
Show all
Hide all
Viewer properties
Property
Value
autoRefresh
True
auxiliaryEdge
False
background
0 0 0 1
culling
1
cutawayMode
union
defaultColour
1 1 1 1
defaultTextColour
0 0 1 1
edge
False
explodeFactor
1 1 mm
globalLineWidthScale
1
globalMarkerScale
1
hiddenEdge
False
hiddenMarker
False
lightsMove
object
lightsThetaPhi
54.7356 45 deg
lightsVector
1 1 1
lineSegmentsPerCircle
24
picking
False
projection
orthogonal
rotationStyle
constrainUpDirection
Picking informations
Picking mode active
Useful tips
viewer-0 (OpenGLStoredQt)
Visualization, one tab per viewer
Interactivity with mouse: rotate, zoom, move, pick
Output
Drift Chamber 2 has 5 hits.
Layer[0] : time 34.706100916825 (nsec) --- local (x,y) -224.16660513171, -0.21355242280892
Layer[1] : time 36.37640752814 (nsec) --- local (x,y) -251.45832124829, -1.2334283123023
Layer[2] : time 38.046694157875 (nsec) --- local (x,y) -278.6416463582, -2.2065434918955
Layer[3] : time 39.717018612375 (nsec) --- local (x,y) -306.03356668968, -3.1589879612698
Layer[4] : time 41.387329111728 (nsec) --- local (x,y) -333.34494482692, -4.2231537511901
EM Calorimeter has 7 hits. Total Edep is 967.12227158091 (MeV)
Hadron Calorimeter has 0 hits. Total Edep is 0 (MeV)
Run terminated.
Run Summary
Number of events processed : 1
User=0.07s Real=0.09s Sys=0.01s
... write Root file : B5.root - done
WARNING: 1 event has been kept for refreshing and/or reviewing.
"/vis/reviewKeptEvents" to review them.
/control/shell ls
Session :
34


exampleB5
Scene tree, Help, History
Scene tree
Help
History
viewer-0 (OpenGLStoredQt)
Scene tree
Scene tree : viewer-0 (OpenGLStoredQt)
Touchables
Show all
Hide all
Viewer properties
Property
Value
autoRefresh
True
auxiliaryEdge
False
background
0 0 0 1
culling
1
cutawayMode
union
defaultColour
1 1 1 1
defaultTextColour
0 0 1 1
edge
False
explodeFactor
1 1 mm
globalLineWidthScale
1
globalMarkerScale
1
hiddenEdge
False
hiddenMarker
False
lightsMove
object
lightsThetaPhi
54.7356 45 deg
lightsVector
1 1 1
lineSegmentsPerCircle
24
picking
False
projection
orthogonal
rotationStyle
constrainUpDirection
Picking informations
Picking mode active
Useful tips
viewer-0 (OpenGLStoredQt)
Toolbar and menubar controlled by icons.mac file,
add your own without coding
Output
Drift Chamber 2 has 5 hits.
Layer[0] : time 34.706100916825 (nsec) --- local (x,y) -224.16660513171, -0.21355242280892
Layer[1] : time 36.37640752814 (nsec) --- local (x,y) -251.45832124829, -1.2334283123023
Layer[2] : time 38.046694157875 (nsec) --- local (x,y) -278.6416463582, -2.2065434918955
Layer[3] : time 39.717018612375 (nsec) --- local (x,y) -306.03356668968, -3.1589879612698
Layer[4] : time 41.387329111728 (nsec) --- local (x,y) -333.34494482692, -4.2231537511901
EM Calorimeter has 7 hits. Total Edep is 967.12227158091 (MeV)
Hadron Calorimeter has 0 hits. Total Edep is 0 (MeV)
Run terminated.
Run Summary
Number of events processed : 1
User=0.07s Real=0.09s Sys=0.01s
... write Root file : B5.root - done
WARNING: 1 event has been kept for refreshing and/or reviewing.
"/vis/reviewKeptEvents" to review them.
/control/shell ls
Session :


exampleB5
Scene tree, Help, History
Scene tree
Help
History
Search :
Command
control
units
process
gui
geometry
tracking
event
cuts
run
particle
verbose
dumpList
addProcManager
buildPhysicsTable
storePhysicsTable
retrievePhysicsTable
setStoredInAscii
applyCuts
dumpCutValues
dumpOrderingParam
initialize
beamOn
verbose
printProgress
numberOfThreads
useMaximumLogicalCores
pinAffinity
eventModulo
dumpRegion
dumpCouples
Command /run/particle/addProcManager
Guidance : add process manager to specified particle type
Parameter
Guidance
Type
Ommitable
Default
Range
1
particleType
s
True
Useful tips
viewer-0 (OpenGLStoredQt)
Help tree browser, free text search
Output
Drift Chamber 2 has 5 hits.
Layer[0] : time 34.706100916825 (nsec) --- local (x,y) -224.16660513171, -0.21355242280892
Layer[1] : time 36.37640752814 (nsec) --- local (x,y) -251.45832124829, -1.2334283123023
Layer[2] : time 38.046694157875 (nsec) --- local (x,y) -278.6416463582, -2.2065434918955
Layer[3] : time 39.717018612375 (nsec) --- local (x,y) -306.03356668968, -3.1589879612698
Layer[4] : time 41.387329111728 (nsec) --- local (x,y) -333.34494482692, -4.2231537511901
EM Calorimeter has 7 hits. Total Edep is 967.12227158091 (MeV)
Hadron Calorimeter has 0 hits. Total Edep is 0 (MeV)
Run terminated.
Run Summary
Number of events processed : 1
User=0.07s Real=0.09s Sys=0.01s
... write Root file : B5.root - done
WARNING: 1 event has been kept for refreshing and/or reviewing.
"/vis/reviewKeptEvents" to review them.
/control/shell ls
Session :


exampleB5
Scene tree, Help, History
Scene tree
Help
History
/run/beamOn 1
/control/shell ls
Useful tips
viewer-0 (OpenGLStoredQt)
History, re-select command
Output
Drift Chamber 2 has 5 hits.
Layer[0] : time 34.706100916825 (nsec) --- local (x,y) -224.16660513171, -0.21355242280892
Layer[1] : time 36.37640752814 (nsec) --- local (x,y) -251.45832124829, -1.2334283123023
Layer[2] : time 38.046694157875 (nsec) --- local (x,y) -278.6416463582, -2.2065434918955
Layer[3] : time 39.717018612375 (nsec) --- local (x,y) -306.03356668968, -3.1589879612698
Layer[4] : time 41.387329111728 (nsec) --- local (x,y) -333.34494482692, -4.2231537511901
EM Calorimeter has 7 hits. Total Edep is 967.12227158091 (MeV)
Hadron Calorimeter has 0 hits. Total Edep is 0 (MeV)
Run terminated.
Run Summary
Number of events processed : 1
User=0.07s Real=0.09s Sys=0.01s
... write Root file : B5.root - done
WARNING: 1 event has been kept for refreshing and/or reviewing.
"/vis/reviewKeptEvents" to review them.
/control/shell ls
Session :


exampleB5
Scene tree, Help, History
Scene tree
Help
History
viewer-0 (OpenGLStoredQt)
Scene tree
Scene tree : viewer-0 (OpenGLStoredQt)
Touchables
worldPhysical [0]
magneticPhysical [0]
firstArmPhysical [0]
hodoscope1Physica...
Show all
Hide all
Viewer properties
Property
Value
autoRefresh
True
auxiliaryEdge
False
background
0 0 0 1
culling
1
cutawayMode
union
defaultColour
1 1 1 1
defaultTextColour
0 0 1 1
edge
False
explodeFactor
1 1 mm
globalLineWidthScale
1
globalMarkerScale
1
hiddenEdge
False
hiddenMarker
False
lightsMove
object
lightsThetaPhi
54.7356 45 deg
lightsVector
1 1 1
lineSegmentsPerCircle
24
picking
False
projection
orthogonal
rotationStyle
constrainUpDirection
Picking informations
Picking mode active
Useful tips
viewer-0 (OpenGLStoredQt)
Scene tree: edit visualization (e.g. hide volumes)
Output
Drift Chamber 2 has 5 hits.
Layer[0] : time 34.706100916825 (nsec) --- local (x,y) -224.16660513171, -0.21355242280892
Layer[1] : time 36.37640752814 (nsec) --- local (x,y) -251.45832124829, -1.2334283123023
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Layer[3] : time 39.717018612375 (nsec) --- local (x,y) -306.03356668968, -3.1589879612698
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Run Summary
Number of events processed : 1
User=0.07s Real=0.09s Sys=0.01s
... write Root file : B5.root - done
WARNING: 1 event has been kept for refreshing and/or reviewing.
"/vis/reviewKeptEvents" to review them.
/control/shell ls
Session :

Movies: Time Development of the Event

SLAC

You can make movies that show Time Development of an event

- I.e., a shower in slow motion

Based on technique of "time-slicing", breaking trajectories into individual slices, each with a time attribute.

- requires newer visualization features, rich trajectory and some extensions to the OpenGL driver
- you can run these animations directly from Geant4, does NOT involve stitching together a movie by hand

A collection of example movies has been prepared by John Allison:
http://www.hep.man.ac.uk/u/johna/pub/Geant4/Movies/

How-To Presentation:

http://geant4.slac.stanford.edu/Presentations/vis/HowToMakeAMovie.ppt

http://geant4.slac.stanford.edu/Presentations/vis/HowToMakeAMovie.pdf

http://www.hep.man.ac.uk/u/johna/pub/Geant4/Movies/pi-10Gevpi+neutronSideView.mp4

10 GeV pion

3 ns

Mpeg4 encoding
with QuickTime Pro